

Nonsurgical healing of large periradicular lesions using a triple antibiotic paste: A case series

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Abstract

The infection of the root canal system is considered to be a polymicrobial infection, consisting of both aerobic and anaerobic bacteria. Because of the complexity of the root canal infection, it is unlikely that any single antibiotic could result in effective sterilization of the canal. A combination of antibiotic drugs (metronidazole, ciprofloxacin, and minocycline) is used to eliminate target bacteria, which are possible sources of endodontic lesions. Three case reports describe the nonsurgical endodontic treatment of teeth with large periradicular lesions. A triple antibiotic paste was used for 3 months. After 3 months, teeth were asymptomatic and were obturated. The follow-up radiograph of all the three cases showed progressive healing of periradicular lesions. The results of these cases show that when most commonly used medicaments fail in eliminating the symptoms then a triple antibiotic paste can be used clinically in the treatment of teeth with large periradicular lesions.

Keywords: Ciprofloxacin, metronidazole, minocycline, nonsurgical root canal treatment, periradicular lesion, triple antibiotic paste

Introduction

The role of microorganisms in the development and perpetuation of pulp and periapical diseases has clearly been demonstrated in animal models and human studies.^[1,2] The most important principle of treating periradicular lesions is to eliminate the bacteria. A large periradicular lesion may have direct communication with the root canal system and respond favorably to nonsurgical treatment.^[3] Some clinical studies have confirmed that simple nonsurgical treatment with proper infection control can promote healing of large lesions.^[4,5] When this treatment is not successful in resolving the periradicular pathosis, additional treatment options should be considered. Surgery may occasionally be required.

In recent years, the Cariology Research Unit of the Niigata University has developed the concept of “Lesion sterilization and tissue repair LSTR” therapy^[6,7] that employs the use of a combination of antibacterial drugs (metronidazole, ciprofloxacin, and minocycline) for the disinfection of oral infectious lesions, including dentinal, pulpal, and periradicular lesions. In studies,^[8,9] oral lesions have been analyzed with strict anaerobic conditions to understand the target bacteria in endodontic treatment and on this basis, antibacterial drugs have been selected. Metronidazole has a wide spectrum of bactericidal action against oral obligate anaerobes,^[10] even against isolates from infected necrotic pulps^[11] and, in fact,

more than 99% of bacteria found in carious lesions^[12] and infected root dentine^[13] were not recovered in the presence of 10 µg per ml metronidazole in *in vitro* experiments. However, metronidazole, even at a concentration of 100 µg per ml, could not kill all the bacteria,^[13] indicating that other drugs may be needed to sterilize the infected root dentine. It has been reported that a mixture of antibacterial drugs, i.e., metronidazole, ciprofloxacin, and minocycline, can sterilize the root dentine.^[14]

The following case reports describe the endodontic treatment of a large periradicular lesion using a combination of antibiotic drugs.

Case 1

A 20-year-old male was referred to the Department of Conservative Dentistry and Endodontics because of swelling in his left mandibular region. His medical status was noncontributory. According to the patient's clinical records, he reported a history of pain in the lower left side 1 month back. He consulted a general dentist, where caries excavation in the left mandibular first molar (tooth 36) was done followed by temporary restoration.

On extraoral examination, there was a bone expansion on the left area of the mandible. On intraoral examination, there was a hard swelling of the buccal vestibule cortex in the concerning region covered with normal mucosa. Tooth 36 had occlusal caries, which was slightly tender to percussion with probing and exhibited normal mobility. The electronic pulp test was negative for tooth 36. A panoramic radiograph showed a well-circumscribed radiolucent lesion located around the apex of the distal root of tooth 36 [Figure 1A] just

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above the mandibular canal. The lesion was approximately 10 mm in maximum diameter. After evaluating all the data, a root canal treatment of the left first molar was planned. At the same appointment, the root canal treatment was initiated on tooth 36. A rubber dam was applied and the access cavity was prepared. A hemorrhagic, purulent exudate was found from the distal canal of tooth 36. The working length was estimated using an apex locator. The distal canal was instrumented with size 15–40 K-files and mesial canals with size 15–30 K-files using a step-back technique. During the instrumentation, the canal was irrigated copiously with 3% sodium hypochlorite solution using a 27-gauge endodontic needle after each instrument. Drainage was performed until the discharge through the canal ceased. The canals were dried with sterile paper points and then dressed with calcium hydroxide. A sterile cotton pellet was inserted into the access cavity before sealing it with a temporary filling material. The calcium hydroxide dressing was changed every 1 week for three times. After 3 weeks, the discharge from the canals did not cease completely. The treatment procedure was changed. The canals were irrigated and the smear layer was removed with 17% EDTA followed by 3% sodium hypochlorite. The canals were dried, and a triple antibiotic paste consisting of ciprofloxacin, metronidazole, and minocycline (100 mg of each drug in 0.5-ml total volume) was placed with the help of a lentulo spiral. The compounding of the antibiotic paste was standardized for all three cases. The paste was

changed every month for a period of 3 months until the teeth displayed no symptoms. On examination, the teeth showed no pain on percussion, soft tissues were found healthy, and the canals were dry. The canals were irrigated with 3% sodium hypochlorite followed by normal saline and obturated with gutta-percha and AH plus by using a lateral compaction technique. The restoration was accomplished with silver amalgam. After 12 months [Figure 1B] and 16 months [Figure 1C], the radiographs showed complete bony healing with well-defined trabeculae.

Case 2

A 17-year-old boy was referred to the Department of Conservative Dentistry and Endodontics because of swelling in his upper front region. His medical status was noncontributory. According to his questionnaire, 4 years earlier he was hit by a ball and had broken his maxillary right lateral incisors. It was left untreated for many years. Three years later, the patient developed swelling in the upper front region for which he consulted a general dentist. The dentist extracted the right fractured lateral incisor. After 11 months, he again developed swelling and pain in the same region. He again consulted the same dentist. A root canal treatment was performed in the upper right central incisor and the dressing of calcium hydroxide was given. The patient was told to return after 2 weeks. The symptoms did not subside; hence, the patient came to our department for consultation.

A panoramic radiograph showed a well-circumscribed radiolucent lesion extending from the apices of teeth 13 to 11 [Figure 2A]. The lesion was approximately 14 mm in diameter.

Thermal and electronic pulp testing was negative for tooth 13. After evaluating all the data, nonsurgical endodontic root canal treatment of teeth 13 and 11 was planned. Teeth were isolated with a rubber dam and access opening was done. Upon access, a thick purulent discharge exuded from the



Figure 1A: Preoperative panoramic radiograph showing large peri-radicular lesion in left mandibular region



Figure 1B: Healing seen 12 months after obturation

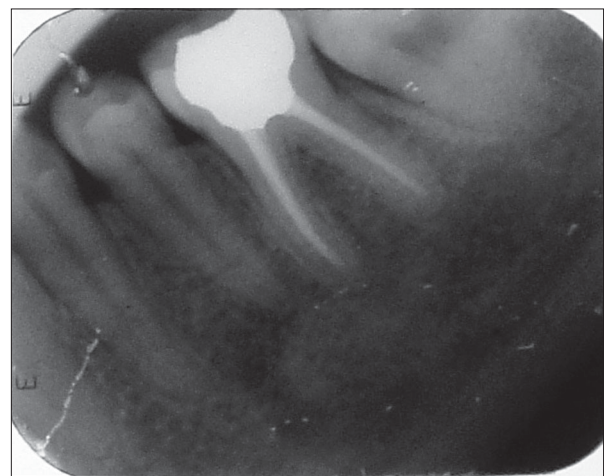


Figure 1C: IOPA 16 months after obturation new

orifices of the canals. After ensuring the presence of a clean root canal, a working length radiograph was taken. The teeth were instrumented to ISO size 60 for the central incisor and 70 for the canine tooth by using the step-back technique. During the instrumentation, the canal was irrigated copiously with a 3% sodium hypochlorite solution. The canals were dried and the calcium hydroxide dressing was given. The calcium hydroxide dressing was changed every 1 week for four times. As the discharge did not cease completely and the symptoms still persisted, the treatment procedure was changed. The canals were irrigated and dried, a triple antibiotic paste was placed, and the teeth were temporized.

The patient was called after a 1-month interval for refreshing the triple antibiotic paste in the canals. After 3 months, the canals were irrigated with 2.5% sodium hypochlorite and obturated with gutta-percha and AH plus. The restoration was accomplished with composite resin. The patient returned to the department for the 10-month follow-up examination and was asymptomatic. Radiographic examination [Figure 2B] showed progressive healing of lesions associated with each tooth.

Case 3

A 19-year-old male was referred to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain and swelling in his upper right front region. His medical status was noncontributory. After questioning, it

was learnt that 5 years back he had got his upper jaw hurt in an accident. After 3 years, he developed swelling in the upper front region and consulted a local dentist. The dentist did root canal treatment of right central and lateral incisors. For next 1 year, the patient was asymptomatic, but there after, he again developed swelling and pain in the upper front region. It was at that point of time he came to our department.

An extraoral examination revealed a diffuse swelling on the right side of upper lip. An intraoral examination showed discolored and tender maxillary right central and lateral incisors. Periapical radiographs showed poorly obturated canals and a large radiolucent lesion with a well-defined margin around the apices of teeth 11 and 12 [Figure 3A]. The lesion was approximately 13×17 mm in maximum diameter. After evaluating all the data, a root canal retreatment of teeth 11 and 12 was planned. A rubber dam was applied, and the access cavities were prepared. The drainage of pus was noted from both teeth. Both teeth were instrumented to ISO size 60 by using the step-back technique. During instrumentation, the canals were irrigated with 3% sodium hypochlorite and then dried and dressed with calcium hydroxide. During the next 3 weeks, the patient was examined weekly, and in each visit the calcium hydroxide dressing was changed. After 3 weeks, the swelling had subsided, but the patient complained of constant dull pain and heaviness in the concerned region. The canals were wet and showed mild discharge. The treatment procedure was changed. The canals were irrigated and dried, a triple antibiotic paste was placed, and the teeth were temporized. The paste was changed every month for a period 3 months until the teeth displayed no symptoms. After 3 months the canals were irrigated with 2.5% sodium hypochlorite and obturated with gutta-percha and AH plus. The restoration was accomplished with composite resin. The patient returned to the department for the 1-year follow-up examination and was asymptomatic. Radiographic examination [Figure 3B] showed progressive healing of lesions.



Figure 2A: Preoperative panoramic radiograph showing large radiolucent lesion



Figure 2B: Ten months after obturation

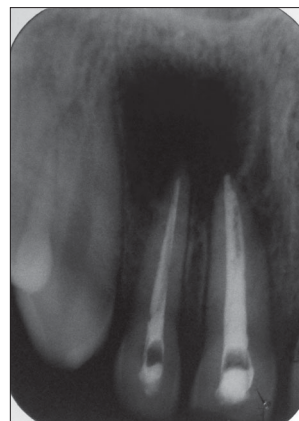


Figure 3A: Preoperative IOPA showing large radiolucency in left mandibular region



Figure 3B: IOPA showing healing seen 12 months after obturation

Discussion

The development and progression of endodontically induced periapical lesions is clearly associated with the presence of microorganisms in the root canal system.^[1,11] There are surgical and nonsurgical methods to treat such cases. Ideally, a nonsurgical method should initially be done especially in cases where lesions are in close proximity to important anatomical landmarks. The success of the nonsurgical endodontic treatment method is based on appropriate cleaning, shaping, asepsis, and filling of the root canal.^[15] It has been reported that the sterilization of the root canal and periradicular region results in good healing of periapical diseases in adults.^[16] In order to sterilize the infected root dentine, especially the deep layers, antibacterial medicaments are useful. These compounds should reach the deeper layers of the infected dentine.

Calcium hydroxide is the most commonly used medicament for the asepsis of the root canal because of its high alkalinity and antibacterial activity. The antimicrobial effects of calcium hydroxide have also been evaluated by clinical studies where calcium hydroxide has been shown to successfully disinfect root canals following 1-month dressing in 97% of treated cases.^[17] The success of a calcium hydroxide dressing for the endodontic treatment of children's teeth with large periradicular lesions has been shown.^[18] However, in another study on the treatment of a tooth with dens invaginatus that was associated with a large periradicular lesion, a calcium hydroxide paste was used as the dressing material, but the enlargement of the periradicular lesion was seen. Therefore, a triple antibiotic paste was used next, and this paste produced successful clinical results.^[19]

In this study, calcium hydroxide was used, but the symptoms were not relieved. The treatment protocol was changed, and a triple antibiotic paste was used instead. After its application, the symptoms resolved. Since the overwhelming majority of bacteria in the deep layers of the infected dentine of the root canal wall consist of obligate anaerobes,^[20] metronidazole was selected as the first choice among antibacterial drugs. It is reported that metronidazole can penetrate the deep layers of carious lesions and disinfect the lesions *in vivo*^[21] and diffuse throughout the dentine.^[22] As the bacterial flora of the root canal with a periradicular lesion is complex in nature,^[13,20] metronidazole alone cannot kill all bacteria^[13] indicating that other drugs may be necessary to sterilize the infected root dentine. Thus, ciprofloxacin and minocycline, in addition to metronidazole were required to sterilize the infected root dentine.

Research with topical antibiotics has shown that a combination of metronidazole, ciprofloxacin, and minocycline is effective in killing common endodontic pathogens from necrotic/infected root canals *in vitro*.^[23] This antibiotic combination is also an effective disinfectant *in vivo*.^[19,24] Furthermore, the triple antibiotic paste has been used successfully in regenerative

endodontic treatments^[25] and in healing of large periradicular lesions.^[26]

Caution should be taken in general when giving local or systemic drugs. Although the volumes of the drugs applied in this therapy were small and there were no reports of side effects, care should be taken if patients are sensitive to chemicals or antibiotics.

The compounding of the triple antibiotic paste was standardized in this series of cases. Each batch of the triple antibiotic pastes was compounded within 24 h of use and was removed from the canals after every 1 month of placement for 3 months. The antibiotic paste contained 100 mg of each of the three antibiotics in a total volume of 0.5 ml. The pharmaceutical carrier propylene glycol was used. These ingredients allow increased solubility and delivery of the paste into the canal. Aqueous solutions of antibiotics can often degrade and this degradation is increased by a rise in temperature and pH.

Conclusion

When the most commonly used medicament fail to eliminate the symptoms, then a triple antibiotic paste can be used as an alternative material. The periradicular lesion in all three cases was large but showed progressive healing after using a triple antibiotic paste in the canal. Every effort should be made to treat such lesions irrespective of size by a nonsurgical endodontic treatment method.

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